CHAPTER 2

2. ALTERNATIVES INCLUDING THE PROPOSED ALTERNATIVE ACTIONS

2.1. Proposed Alternative Actions

For the reduction of NO_x emissions from COF, TVA is considering three alternative combinations of systems, i.e., installation of SCR on Unit 5 and No Action on Units 1 through 4 (Alternative A); installation of SCRs on all five units (Alternative B); or a hybrid consisting of an SCR on Unit 5 and different combinations of SCR and NO_xTech systems on Units 1 through 4 (Alternative C). Since Unit 5 is the largest unit at COF, Alternative A offers the timeliest way to affect a large decrease in NO_x emissions from COF. Both Alternatives B and C would seek to control NO_x emissions from all five units. However, while Alternative B would have SCRs on all five units, Alternative C includes variations whereby either SCR or NO_xTech might be installed on Units 1 through 4, depending on further evaluation of the effectiveness of NO_xTech systems.

The Unit 5 outages for installation of the SCR are planned for early 2003 and 2004. Installation of NO_x removal equipment on Units 1-4 may also begin in 2003. TVA expects a 90 percent NO_x removal efficiency with both the SCR and NO_xTech systems. The proposed Unit 5 SCR system includes a reactor housing and ductwork, catalyst, and an anhydrous ammonia system for unloading, storage, vaporization, air dilution, injection, and control of ammonia.

For the purposes of assessing environmental impacts, continuous year-round operation of the SCRs with ammonia injection was assumed. Further, assessment of the impacts of Alternative C has been undertaken on the assumption that all four of the smaller Units (Units 1 through 4) would have NO_xTech system. A hybrid (under Alternative C) that uses less than four NO_xTech systems would be less impactive on the environment. The greater ammonia slip for a NO_xTech system than for SCR causes impacts on water quality and waste management for a NO_xTech system to be higher than an SCR.

2.1.1. Present Flue Gas Treatment at Colbert Fossil Plant

The present flue gas treatment systems for environmental control for COF Units 1 through 5 consist of the following train of components in order of treatment: a high-efficiency ESP induced draft fan and the unit stack (see Figure 2); the air heater (also located in the flue gas stream) which preheats boiler combustion air and is located upstream of the ESP for each unit (see Figure 2); the flue gas ductwork for Units 1 through 4, which passes through older ESP hoppers to reach the newer, high-efficiency ESPs.

2.1.2. Selective Catalytic Reduction System (SCR) Under Alternatives A, B, and C

The SCR reactor(s) would be physically installed upstream of the air heater in the gas path. The existing flue gas ductwork would be modified to accommodate the SCR reactor(s). The ESPs would remain the primary particulate control device providing compliance with the particulate emission standard for the units. An ammonia system capable of serving the SCR system(s) would be installed and would consist of an area for truck delivery and unloading, storage tanks, feed pumps, vaporizers and dilution air mixing units, and necessary controls.

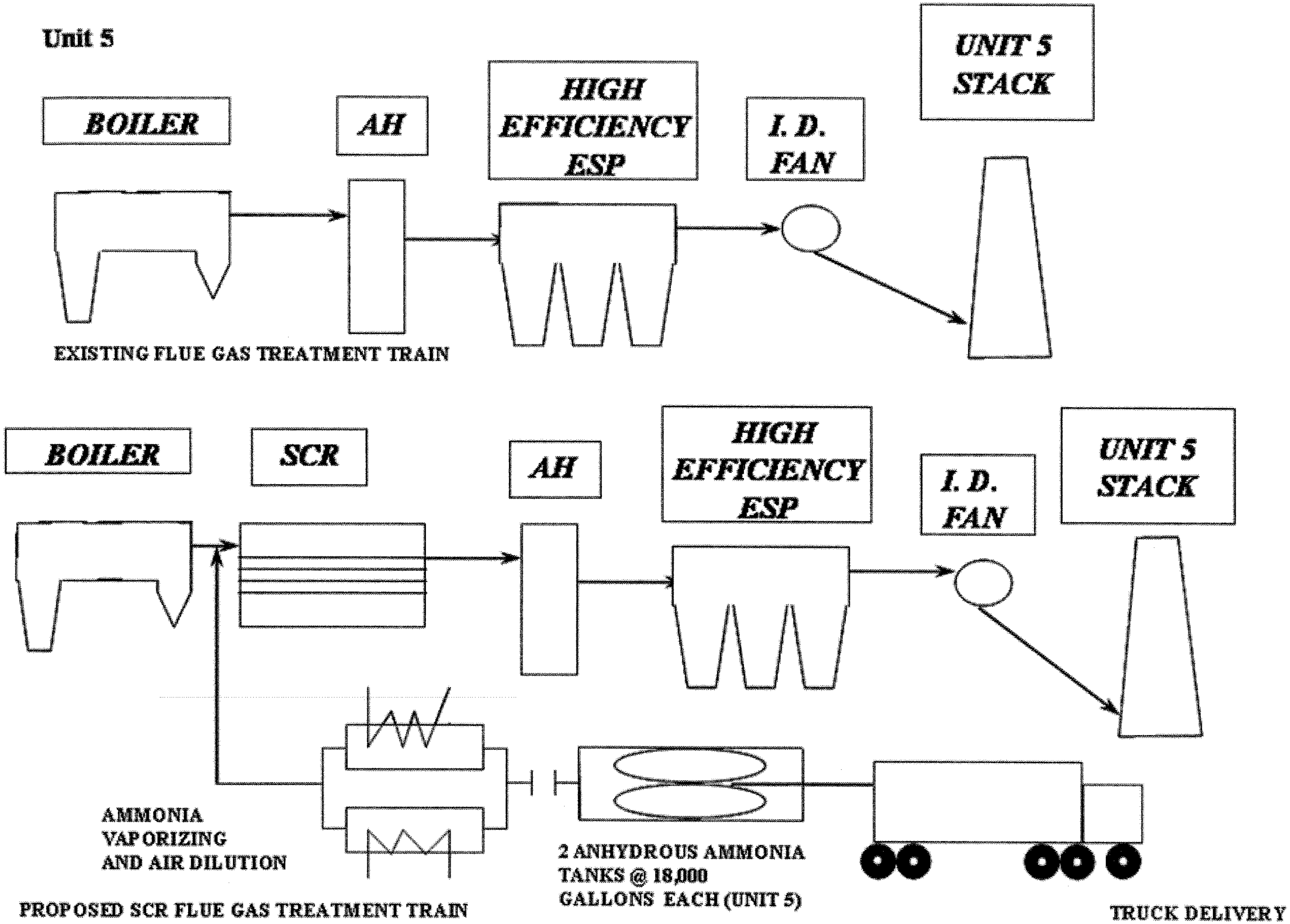

Figure 2. Existing and Proposed SCR Flue Gas Treatment Trains for COF Unit 5 (Alternatives A and B)

The proposed arrangement for a COF "high-dust" SCR system (i.e., on the high-dust side of ESPs), includes either one (Alternative A), a total of five (Alternative B), or anywhere from one to five (Alternative C) SCR reactors (one SCR reactor per boiler unit). The SCR serving Unit 5 would be installed first and would be physically located (Figures 2 and 4) upstream of the high-efficiency ESP to the northwest of Unit 5. The SCRs for Units 1 through 4 would be constructed in the space created by the demolition of the old low-efficiency ESPs for Units 1 through 4 (see Figure 4).

The flue gas would be routed through the SCR and returned to the existing ductwork. The high-efficiency ESPs would continue to provide compliance with the particulate emission standard.

The SCR installation on Units 1 through 4 would be very similar to that described above.

The proposed SCR arrangement would utilize most of the existing ductwork, including the common plenums for Units 1 through 4, but would require some additional duct, i.e., duct going from the boiler economizers to the SCR, duct from the SCR to the air preheater (APH), duct coming from the APH outlet to the induced draft fan or directly to the high-efficiency ESP (for Units 1 through 4). Once the flue gas exits the ESP, the flue gas would be discharged to the common plenum discharging to the stack.

The SCR modules are designed to accommodate three levels of honeycomb catalyst beds. The honeycomb catalyst is an extruded ceramic structure with high geometric surface area per unit volume. Composition of the catalyst is a titanium-tungsten material that is highly reactive to NO_x. Initially, two layers would be installed, with a third layer added as dictated by the Catalyst Management Plan.

2.1.3. Alternative C Hybrid (SCR on Unit 5 and NO_xTech System or SCR on Units 1 through 4)

The NO_xTech system is a proprietary technology. Installation of the NO_xTech system would theoretically require substantively less construction and modification to existing plant flue gas ductwork than installation of SCRs (Figure 3). TVA tested a NO_xTech system at KIF Unit 9, Kingston, Tennessee, from January to May 2002. Analysis of operating data from this testing will be used to determine feasibility and effectiveness of the NO_xTech system. If results of the testing show sufficient advantages, NO_xTech may be chosen for COF Units 1 through 4.

The NO_xTech system would involve installation of supply lines, nozzles, and devices within the plant structure to inject controlled amounts of ammonia and natural gas into each of the individual boilers. The NO_xTech installation consists of a natural gas or propane/steam mixture and ammonia supply grid. Each of the grids consists of a number of lances installed at the entry to the particular NO_xTech injection cavity. Modifications may occur due to design refinements resulting from the initial tests on KIF Unit 9.

Supply lines for natural gas would be constructed from the natural gas metering station (Blue Box labeled "Gas" in Figure 4) on the south side of the plant to the south corner of the powerhouse along a corridor labeled "NG" in Figure 4 and then through the plant structure to the injection points on the boilers.

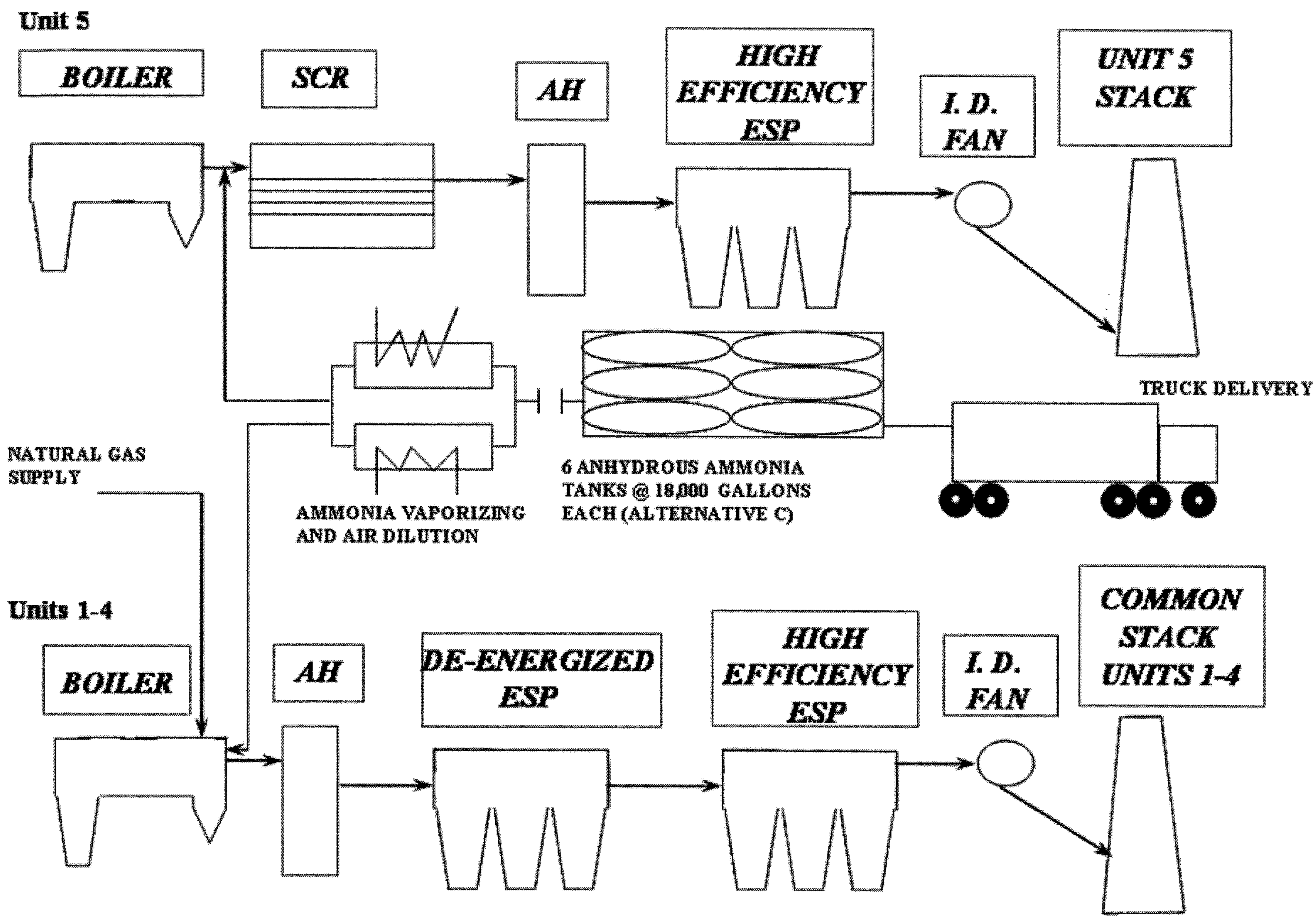

Figure 3. Proposed SCR Flue Gas Treatment for COF Unit 5 and NO_xTech for Units 1 through 4 (Alternative C)

Figure 4 Colbert NOx Removal Footprint

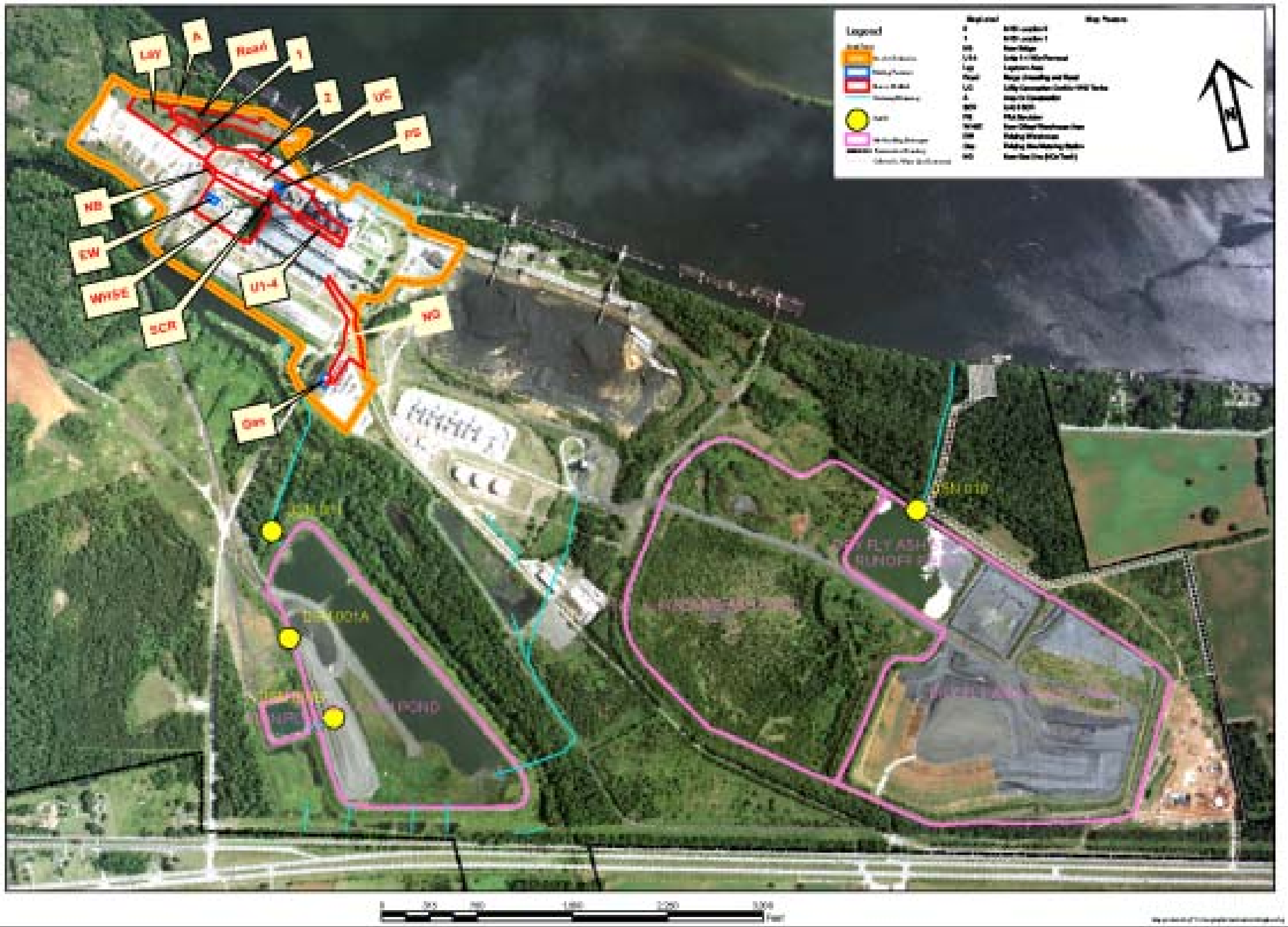

Figure 4. Colbert NO_X Removal Footprint

Laydown areas for the NO_xTech system would be in the vicinity of the boilers and within the areas previously disturbed for construction of the existing plant structure. If TVA decides to install NO_xTech systems on COF Units 1 through 4 under Alternative C, the temporary barge unloading area would no longer be needed after the installation of the Unit 5 SCR is completed. No temporary buildings are needed for the NO_xTech installation, and as for the SCR, installation of a few warehouse-type storage buildings would be erected in the area currently shown for offices and warehouses in Figure 4.

2.2. Project Components Common to the Action Alternatives

2.2.1. Ammonia Storage and Handling System

For all three Action Alternatives, an ammonia system capable of serving either the SCR system(s) or the SCR and NO_xTech installations would be installed and would consist of an area for truck parking and unloading, storage tanks (nominal capacity of 18,000 or 30,000 gallons each as shown in Table 1), feed pumps, vaporizers and dilution air mixing units, and necessary controls. Four locations were initially considered as possible ammonia delivery and storage locations; the first two sites were eliminated due to safety concerns. The two remaining ammonia storage tank sites and the location of the SCR reactors are shown in Figure 3. Ammonia Tank Location 1 is the preferred location, and Ammonia Tank Location 2 is the alternate location. Tanker truck size for deliveries would be approximately 7,000 to 8,000 gallons. On-site storage for ammonia would vary from two 18,000-gallon tanks for Alternative A to either six 18,000-gallon tanks or four 30,000-gallon tanks for Alternative C.

The NO_xTech system would require an ammonia usage rate approximately 2.5 times that of the SCRs. Truck deliveries of ammonia would be proportional. Use of SCRs (Alternatives A and B) would require approximately three to eight truck deliveries of ammonia per week, whereas NO_xTech/SCR Alternative C would require approximately 14 to 15 truck deliveries per week (see Table 1).

The location of SCR reactors, and ammonia storage tanks and unloading area are shown in Figure 4. Also included in the system would be the necessary utility supply lines for electrical power, potable water, raw water, instrumentation, and controls. These would be routed through and along areas previously highly disturbed for plant construction. An existing 480-volt power source in a building on the site of Ammonia Tank Location 1 is being considered as a potential power source for the Ammonia Storage/Unloading Area. If the existing 480-volt power source proves unfeasible, power would most likely be supplied from a station service transformer near the western corner of the powerhouse. The electrical power, potable water, raw water, instrumentation and control lines, and ammonia pipelines would be located in the utility corridor area (marked “UC” in Figure 4). Additionally, a water fogging system activated both automatically and manually would be installed to limit the hazard from any accidental release of anhydrous ammonia from either the storage tanks or an unloading tank truck. The fogging system would combine water with a portion of the anhydrous ammonia vapor (the remainder would off-gas) to form aqueous ammonia liquid. This liquid along with any runoff from the unloading operations area would be contained within the compacted-earth catch basin surrounding the storage tank and unloading area. This containment would be sized for storm water runoff from a 10-year, 24-hour event, one tank's contents and deluge system associated with catastrophic release. Following pH testing, spilled material would then be released to one of the ash ponds (most likely Ash Pond 4) at a rate sufficient to maintain compliance with the National Pollutant Discharge Elimination System (NPDES) permit requirements for the ash pond. In a similar manner, routine storm water accumulations in the secondary containment would also be released to Ash Pond 4.

Table 1. Ammonia Tank Configurations and Ammonia Usage Rates for Action Alternatives

Ammonia Tank Configurations				
Alternative	**Description**	**No. Tanks**	**Volume of Tanks (Gallons)**	**Total On-Site Ammonia Storage (Gallons)**
A	Unit 5 SCR and No Action Units 1 through 4	2	18,000	36,000
B	Units 1 through 5 SCRs	4	18,000	72,000
C	Unit 5 SCR and NO_xTech Units 1 through 4	6	18,000	108,000
Ammonia Usage Rates				
Alternative	**Description**	**lb NH_3 / Hour**	**NH_3 Truck Deliveries per Week**	
A	Unit 5 SCR and No Action Units 1 through 4	756	3 to 4	
B	Units 1 through 5 SCRs	1,856	7 to 8	
C	Unit 5 SCR and NO_xTech Units 1 through 4	3,506	14 to 15	

NH_3 = emission of unreacted ammonia

2.2.2. Other Project-Related Activities

Other attendant activities include:

- Upgrade by gravelling and grading of the temporary barge unloading area for unloading heavy equipment. A maintenance permit from the United States Army Corps of Engineers (USACE) permit will be obtained as necessary. Large components of the SCR systems would be transported to COF by barge and unloaded by crane at an existing barge unloading area. Current plans are to avoid disturbance of the sediments or the river below the high-water line. A crane mat would be put down in the barge unloading area and then the crane would lift equipment off barges. The barges would be moored to existing coffer dams/barge mooring cells.

- Gravelling, grading, and widening of a section of road from the barge unloading area to the new laydown area. This EA will assume up to 30 feet on either side of the road might be disturbed to accomplish this task.

- Preparation of a new laydown area by gravelling and grading (area marked “Lay” in Figure 4).

- Construction of a new bridge over pipe band into main plant area.

- Demolition of old office building/lunchroom associated with old temporary pilot scrubber.

- Demolition of the remains of the old concrete mixing plant (colloquially referred to as “the Alamo”), which was used in the initial construction of COF.

- Construction of temporary or permanent office building(s) and/or remodeling of existing warehouse/office.

- Some of the storm water drains northwest of the powerhouse may be rerouted as necessary to reduce the risk of ammonia spills going directly to the river.

Large components of the SCR systems would be transported to COF by barge as described above. Other components would be delivered to COF by truck. Large bulk deliveries of materials would include steel, duct, insulation, lagging, cables, pipe, machinery, vaporizers, and pumps, switch gear, breakers, and ammonia storage tanks.

2.3. No Action Alternative

Under a No Action Alternative, no SCR or other NO_x reduction systems would be installed. A No Action Alternative would not meet TVA’s systemwide goal of reducing NO_x emissions by 83,000 tons per year. The emissions from COF are part of the NO_x averaging plan that is based upon a CAA Title IV requirement of an averaged 0.40 pounds/millions of British thermal units (lb/mm Btu) for tangentially fired units. COF operates, and under the No Action Alternative would continue to operate, in the 0.40-0.45 lb/mm Btu range.

2.4. Other Alternatives Not Considered in Detail

2.4.1. Technology Alternatives

Other commercially available, proven technologies described under Section 1.3 cannot provide the high NO_x removal rate of 90 percent needed to meet TVA’s systemwide NO_x reduction goal of 75,000 metric tons (83,000 tons) per year. As a result, other NO_x control technologies are not considered further in this EA.

An alternative installation point was analyzed for the physical installation of the SCR arrangement (i.e., termed a “low-dust” installation) into the flue gas flow and plant structure. This alternative installation would also have required construction of a natural gas pipeline to the plant. In the low-dust arrangement the particulate removal device, i.e., ESP, is located upstream of the SCR. That arrangement was eliminated from consideration for installation due to the difficulty of fitting the physical train into the existing plant structure and higher operating costs. The low-dust arrangement has higher operating costs because of the need to reheat the gas stream.

2.4.2. NO_X Reductions from Energy Efficiency, Renewable Energy, and Nuclear Generation

Reduced fossil fuel use made possible by energy efficiency, use of renewable energy, and nuclear power generation are alternatives that would also reduce TVA’s NO_x emissions. These alternatives are being implemented according to the short-term and long-term plans defined in the preferred alternative of TVA, 1995. The effects of these measures are already reflected in TVA’s NO_x reduction requirements. Thus, these measures by themselves would not be adequate to achieve the NO_x reduction requirements under the CAA. Together with the NO_x reductions from the proposed action, these alternatives would help TVA achieve its overall NO_x reduction requirements.

Additional nuclear power generation could offset fossil generation and thus reduce NO_x emissions. TVA has three partially completed nuclear units: Watts Bar 2 and Bellefonte 1 and 2. In addition, Browns Ferry Nuclear Plant (BFN) Unit 1 is shut down and will require considerable refurbishment prior to restart. TVA recently completed a Supplemental Environmental Impact Statement that included possible restart of BFN Unit 1 under an alternative. Any decision to pursue additional nuclear power generation could have some influence on long-term NO_x reduction requirements but falls beyond the time frame for the required completion of TVA NO_x reductions, which is estimated to be 2005.

TVA has also recently begun a pilot Green Power Program. This program would provide power from renewable energy sources with little or no NO_x emissions. However, the NO_x reduction contributions would be small compared to the NO_x reduction requirements under the CAA. Another alternative is the purchase of NO_x allowances from a market—if the USEPA model rule is adopted by all states. This approach would not satisfy TVA's need for reductions under CAA Title I, nor would it produce the needed local ozone reductions to maintain attainment status.

2.5. Comparison of Alternatives

The potential for effects by either the proposed Action Alternatives or No Action Alternative on terrestrial ecology, wetlands and floodplains, land use, visual aesthetics, archaeological and historic resources, transportation, and socioeconomics is minor and insignificant.

2.5.1. Air Quality

The proposed action of installing and operating SCR or NO_xTech systems would have beneficial impacts to regional air quality by reducing the NO_x available in the atmosphere for use in ozone production and thus locally and regionally reducing the ground level ozone. Other possible minor changes in plant emissions include an increase in SO_3 particulate emissions, a decrease in secondary NO_x particulate emissions (leading to an overall decrease in fine particulate), and a decrease in plume coloration from NO_x. In addition, acid precipitation caused by secondary particulate NO_x emissions would be reduced.

The No Action Alternative would result in no changes to the plant air emissions and thus no beneficial reduction in NO_x emissions.

2.5.2. Water Quality and Aquatic Life

The storage, handling, and use of anhydrous ammonia for the proposed SCR system would result in the potential for ammonia contamination of surface water and impacts to aquatic life. One pathway for impacts is a direct accidental release of ammonia to surface waters. The engineered features of the SCR systems include a retention basin for spills and emergency water fogging to minimize this risk. Another pathway for surface water impacts is ammonia contamination of combustion byproducts, including bottom ash and fly ash. Storm water runoff from the dry fly ash stack area would be expected to contain ammonia. Storm water runoff from the dry fly ash stack flows to the dry fly ash stack settling pond (Ash Pond 5), which discharges to the Tennessee River by way of Outfall Discharge Serial Number (DSN) 010. Studies are underway to determine optimum modifications to the dry fly ash stack settling pond, which would ensure that effluent ammonia concentrations comply with expected NPDES permit limitations. Water discharged from the chemical treatment pond to Ash Pond 4 may contain ammonia following an APH washing. Management of water treatment system flows, such as staged release of APH wash water from the chemical treatment pond, would maintain discharge ammonia concentrations from Ash Pond 4 below levels that would safeguard water quality and protect aquatic life. Since NPDES wastewater discharge permits issued by ADEM are designed to prevent degradation of water resources, compliance with permit limitations would ensure no significant impacts to the Tennessee River.

The No Action Alternative would result in no changes to existing conditions of water quality or impacts to aquatic life.

2.5.3. Solid Waste

Some construction and demolition wastes would result from construction of the SCR systems under the Action Alternatives. These wastes could potentially include metal scrap, lumber, masonry, asbestos, and hazardous wastes. These wastes would all be properly managed and disposed of, as necessary, in appropriately permitted disposal units. These wastes would not occur for the No Action Alternative.

The No Action Alternative would not affect combustion byproducts. Under the Action Alternatives the character of combustion solid waste and byproducts, including fly ash may be changed due to ammonia contamination. These changes may constrain some future potential uses of this byproduct, which could in turn affect TVA's management of fly ash disposal for COF. Boiler slag, which is currently not marketed, would not have the potential for ammonia contamination.

2.5.4. Ammonia Storage and Handling Safety

Depending on the extent of and emergency response to accidental releases of ammonia, the potential exists for substantial hazard to plant works or, in the event of more extensive releases, the public.

The estimated impacts from worst-case releases assume complete failure of an ammonia storage tank, followed by a complete failure of the emergency water fogging system, as well as no response by emergency personnel. Additionally, the most unfavorable weather conditions limiting dispersion of the ammonia vapor must also occur to create the worst-case scenario. The complete tank failure and water fogging system failure could possibly result from a tornado or major earthquake. The occurrence of a tornado at the very location of the ammonia tanks is unlikely. Additionally, combining the occurrence of a tornado with the dispersion-unfavorable weather conditions not associated with weather following a tornado must also occur. The probability of these events occurring simultaneously is very unlikely resulting in a low risk of such a worst-case release.

The occurrence of a major earthquake, which could result in complete tank failure and failure of the water fogging system, is unlikely. To minimize this risk, the ammonia storage and handling facility would be designed to be earthquake resistant (see Section 2.6 below).

The No Action Alternative would pose none of these potential hazards.

2.6. Summary of Environmental Commitments

The following environmental commitments and mitigative measures were identified as necessary to ensure that environmental impacts are insignificant:

1. Compliance with 40 Code of Federal Regulations (CFR) 68 prior to filling of the ammonia storage tanks or transport on site of ammonia in a quantity exceeding 10,000 pounds.

2. Substantive compliance with the provisions of 29 CFR 1910.111 (Storage and Handling of Anhydrous Ammonia) and 29 CFR 1910.119 (Process Safety Management of Highly Hazardous Chemicals) including those for proper equipment design, hazard assessment, operating procedures, employee training, and emergency planning.

3. Seismic hazards to the selective catalytic reduction (SCR) facility would be addressed by compliance with the seismic provisions of the 1997 version of the International Conference of Building Officials Uniform Building Code and the 1997 National Earthquake Hazards Reduction Program.

4. If installed, the SCR system(s) shall not be routinely operated with an ammonia slip exceeding 2 parts per million (ppm). Brief system process excursions or process upsets would be an exception to this limit.

5. If installed, the NO_xTech systems shall not be routinely operated with an ammonia slip exceeding 5 ppm. Brief system process excursions or process upsets would be an exception to this limit.

6. TVA would monitor impacts on fly ash and fly ash leachate from ammonia additions involving other TVA projects. Ash Pond 5 would be evaluated to determine optimum means of ensuring that adequate mixing and assimilation of ammonia compounds occur within the pond. Ash Pond 5 would be modified as necessary, most probably by baffling, to ensure adequate mixing and ammonia compound assimilation.

7. Effluent pH of both Ash Pond 4 and Ash Pond 5 would be adjusted as necessary to meet National Pollutant Discharge Elimination System (NPDES) permit requirements.

8. Air preheater wash water would be routed to the chemical pond and then discharged to Ash Pond 4 in stages to allow the assimilative capacity of Ash Pond 4 to reduce ammonia concentrations to acceptable levels at Outfall 001. Existing guidelines for managing the chemical treatment pond would be modified to ensure appropriate management of ammonia-bearing APH wash water.

9. The maximum area of exposed ash at any particular time during the stacking period would not exceed 10 acres (4.05 hectares).

10. In order to contain and control an accidental spill of ammonia, the area around the ammonia unloading and storage area would be configured into a spill retention basin. The spill retention basin would be sized to retain the contents of an entire tank, the anticipated water flow from the fogging system, and the rainfall from the 10-year, 24-hour rain event. The spill retention basin at a minimum would be lined with compacted in-situ earth or low permeability clay liner. Following pH testing, spilled material would be released to the ash pond at a rate sufficient to maintain compliance with NPDES permit requirements for Ash Pond 4.

11. To ensure that local residential wells are not adversely affected by dry stacking of ammoniated ash, future groundwater samples collected semiannually from private wells P2 and P8 would be analyzed for an expanded list of water quality parameters including

ammonia, total nitrate-nitrite, and total Kjeldahl nitrogen. In TVA's judgment should the water quality of any private well be impaired by ammoniated ash leachate such that water is no longer suitable for its intended use, the owner would be provided either a water treatment system, a connection to the local public water system, or a new well.

12. Catalyst disposal would be managed by a catalyst contractor in compliance with applicable regulations.
13. A water fogging system with both automatic and manual activation would be installed at the ammonia storage and unloading facility to limit the hazard from large ammonia leaks or catastrophic tank failure.
14. The COF site storm water pollution prevention plan would be revised to include management of precipitation into secondary containment for ammonia tanks as described in Section 2.2.1 above.
15. During construction, areas subjected to soil disturbance and/or vegetation removal would be replanted and/or reseeded with native plant species as soon as possible.
16. During construction, portable toilets would be provided and appropriately maintained for the construction workforce.
17. Appropriate Best Management Practices for erosion control and stabilization of disturbed areas, including dust suppression, would be utilized, and all construction activities would be conducted in a manner to ensure that waste materials are contained and that introduction of polluting materials into receiving waters are minimized.
18. The crane at the barge unloading area would be relocated if a high-water event is anticipated while the barge unloading area is in use. No materials subject to flood damage would be stored within the 100-year floodplain.

2.7. Environmental Permits

New or modified environmental permits that would have to be obtained for the proposed project are listed in Table 2.

Table 2. Permits
Modification to Alabama NPDES permit AL0003867 for Outfall(s) DSN 001 and DSN 010, as required
Modification to Alabama Air Permits: 701-0010-Z009 for Unit 1 701-0010-Z010 for Unit 2 701-0010-Z011 for Unit 3 701-0010-Z012 for Unit 4 701-0010-Z013 for Unit 5, as required
NPDES general permit for discharge of storm water from construction activity may be required depending upon acreage disturbed
USACE 404 maintenance permit (if needed for upgrade of barge unloading area)